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विस्फोटी गैस पर्यावरणों के लिए बिजली के उपकरण

भाग 20 विद्युत उपकरणों से संबंधित ज्वलनशील गैसों और वाष्पन के आँकड़े

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES

PART 20 DATA FOR FLAMMABLE GASES AND VAPOURS, RELATING TO THE USE OF ELECTRICAL APPARATUS

ICS 29.260.20

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Electrical Apparatus for Explosive Atmospheres Sectional Committee, ETD 22

NATIONAL FOREWORD

This Indian Standard (Part 20) which is identical with IEC 60079-20 : 1996 'Electrical apparatus for explosive gas atmospheres — Part 20: Data for flammable gases and vapours relating to the use of electrical apparatus' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Electrical Apparatus for Explosive Atmospheres Sectional Committee and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60079-0 : 1983[1] Electrical apparatus for explosive gas atmospheres — Part 0: General requirements	IS/IEC 60079-0 : 2004 Electrical apparatus for explosive gas atmospheres: Part 0 General requirements	Technically Equivalent
IEC 60079-1A : 1975[2] Electrical apparatus for explosive gas atmospheres — Part 1: Construction and verification test of flameproof enclosures of electrical apparatus — First supplement: Annex D: Method of test for ascertainment of maximum experimental safe gap	IS 9735 : 2003 Electrical apparatus for explosive gas atmospheres — Flameproof enclosures "*d*" — Method of test for ascertainment of maximum experimental safe gap (*first revision*)	Identical
IEC 60079-3 : 1990[3] Electrical apparatus for explosive gas atmospheres — Part 3: Spark-test apparatus for intrinsically-safe circuits	IS 5780 : 2002 Electrical apparatus for explosive gas atmospheres – Intrinsic safety "i" — Specification (*second revision*)	do
IEC 60079-4 : 1975 Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature	IS 7820 : 2004 Electrical apparatus for explosive gas atmospheres — Method of test for ignition temperature (*first revision*)	do
IEC 60079-8 : 1969[4] Electrical apparatus for explosive gas atmospheres — Part 8: Classification of maximum surface temperatures	IS/IEC 60079-0 : 2004 Electrical apparatus for explosive gas atmospheres: Part 0 General requirements	do

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[1] Since revised in 2004.

[2] Superseded by IEC 60079-1-1 : 2002 which has been adopted as IS 9735 : 2003.

[3] Superseded by IEC 60079-11 : 1999 which has been adopted as IS 5780 : 2002.

[4] Superseded by IEC 60079-0 : 2004 which has been adopted as IS/IEC 60079-0 . 2004.

(*Continued on third cover*)

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES

PART 20 DATA FOR FLAMMABLE GASES AND VAPOURS, RELATING TO THE USE OF ELECTRICAL APPARATUS

1 Scope

This technical report gives guidance on the selection of appropriate electrical apparatus, protected by flame-proof enclosure or designed to be intrinsically safe, according to the gas or vapour in which it is intended to be used.

2 General

Tables of chemical and engineering properties of substances are provided to assist electrical engineers in their selection of electrical apparatus to be used in hazardous areas.

The scope of these data has been selected with particular reference to the use of electrical equipment in hazardous areas, and notice has been taken of standard measurement methods given in IEC 79-1A, IEC 79-3, IEC 79-4 and IEC 79-4A.

NOTES

1 The data in this report have been taken from a number of references which are given in the bibliography (see annex A).

2 Some variations in the data may appear when references are compared, but usually the discrepancy is sufficiently small to be of no importance in the selection of electrical apparatus.

Users of the data in this report should be aware that all its data are the result of experimental determinations, and as such are influenced by variation in experimental apparatus and procedures, and in the accuracy of instrumentation. In particular, some of the data have been determined at temperatures above ambient temperature, so that the vapour is within the flammable range. Variation in the temperature for the determination would be expected to influence the result of the determination; for example: lower flammability limits and maximum experimental safe gap decrease with increasing temperature and/or pressure; upper flammability limits increase with increasing temperature and/or pressure. Data are subject to revision and, where more recent information is required, the use of a maintained database[1] is recommended.

3 Determination of the properties

3.1 *General*

The compounds listed in this technical report are in accordance with IEC 79-12, or have been the subject of a determination of maximum experimental safe gap (MESG), or have physical properties similar to those of other compounds in that list.

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[1] For information on the availability of maintained databases refer to annex A.

3.1.1 *Determination of MESG*

The preferred method for the determination of MESG is the 20 ml vessel (see IEC 79-1A), with 25 mm broad flanges and internal spark ignition 10 mm from the inside edge of the flanges. Usually this method gives the same result as an 8.1 sphere, with the one exception of carbon disulphide (see 4.4).

3.2 *Flame proof apparatus group*

The groups are the result of MESG determination except where there is no value listed for MESG. For these, the group is based on chemical similarity (see IEC 79-12).

3.3 *Flammability limits*

Determinations have been made by a number of different methods, but the preferred method is with a low energy ignition at the bottom of a vertical tube. The values (in percentage by volume and mass per volume) listed for the lower limit are the lowest reported, and for the upper limit are the highest reported.

If the flash point is high, the compound does not form a flammable vapour cloud in air at normal ambient temperature. Where flammability data are presented for such compounds the determinations have been made at a temperature sufficiently elevated to allow the vapour to form a flammable mixture with air.

3.4 *Flash point (FP)*

The value given is the "closed cup" measurement. When this data was not available the "open cup" value is quoted. The symbol < (less than), indicates that the flash point is below the value (in degrees Celsius) stated, this probably being the limit of the apparatus used. The lowest reported value is listed.

3.5 *Temperature class*

The temperature class of a compound is allocated according to IEC 79-0. See also 3.7.

3.6 *Minimum igniting current (MIC)*

The apparatus for the determination of minimum igniting current is defined in IEC 79-3. A contact disc with two grooves rotates to make and break contact with a tungsten wire. The low voltage circuit broken in this way has an inductance of 95 mH.

3.7 *Ignition temperature (IT)*

The value of IT depends on the apparatus [2] used in its determination and the manner in which it is used. The preferred data are those reported in IEC 79-4. If the compound is not included in these data, the data obtained in similar apparatus, such as the apparatus described by the American Society for Testing Materials (ASTM) standard (ASTM E659), is listed [3].

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[2] A description of apparatus agreed as a standard, and some values recorded with that apparatus, are described in IEC 79-4.

[3] Results from using the apparatus described in ASTM D2155 (now replaced by ASTM E659) were reported by C.J. Hilado and S.W. Clark [1]*. The apparatus is similar to the one used by Zabetakis [2]*. If there is no determination by either the IEC apparatus, nor similar apparatus, the lowest value obtained in other apparatus is listed. A more comprehensive list of data for autoignition temperature, with the reference to sources, is given by Hilado and Clark.

* See the Bibliography given in annex A.

4 Properties of particular gases and vapours

4.1 *Coke oven gas* [73]

Coke oven gas is a mixture of hydrogen, carbon monoxide and methane. If the sum of the concentrations (vol %) of hydrogen and carbon monoxide is less than 75 % of the total, flameproof apparatus of Group IIB is recommended, otherwise apparatus of Group IIC is recommended.

NOTE – For all concentrations, Group IIC intrinsically safe apparatus is recommended.

4.2 *Ethyl nitrite* [159]

The auto-ignition temperature of ethyl nitrite is 95 °C, above which the gas suffers explosive decomposition.

NOTE – Ethyl nitrite should not be confused with its isomer, nitroethane.

4.3 *MESG of acetylene* [7]

In clean apparatus an MESG of 0,37 mm is observed, but in apparatus in which carbon has been deposited, for example by an explosion of a rich acetylene/air mixture, ignition can be transmitted through a narrower gap. Acetylene requires Group IIC apparatus.

4.4 *MESG of carbon disulphide* [51]

The MESG for carbon disulphide appears to be size-dependent. Determination of MESG in a 20 ml vessel (see IEC 79-1A) gives a MESG of 0,34 mm, whereas an 8 000 ml vessel gives a MESG of 0,20 mm. Carbon disulphide requires Group IIC apparatus.

4.5 *MESG of carbon monoxide* [52]

The MESG for carbon monoxide relates to a mixture with air saturated with moisture at normal ambient temperature. This determination indicates the use of Group IIB apparatus in the presence of carbon monoxide. A larger MESG may be observed with less moisture. The lowest MESG (0,65 mm) is observed for a mixture of CO/H_2O near 7: molar ratio. Small quantities of hydrocarbon in the carbon monoxide/air mixture have a similar effect in reducing the MESG so that Group IIB apparatus is required.

4.6 *Methane, Group IIA* [184]

Industrial methane, such as natural gas, is classified as Group IIA, provided it does not contain more than 15 % (V/V) of hydrogen. A mixture of methane with other compounds from Group IIA, in any proportion is classified as Group IIA.

5 Reference documents

IEC 79-0: 1983, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 79-1A: 1975, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus – First supplement: Annex D: Method of test for ascertainment of maximum experimental safe gap*

IEC 79-3: 1990, *Electrical apparatus for explosive gas atmospheres – Part 3: Spark-test apparatus for intrinsically-safe circuits*

IEC 79-4: 1975, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature*

IEC 79-4A: 1970, *Electrical apparatus for explosive gas atmospheres – First supplement*

IEC 79-8: 1969, *Electrical apparatus for explosive gas atmospheres – Part 8: Classification of maximum surface temperatures*

IEC 79-12: 1978, *Electrical apparatus for explosive gas atmospheres – Part 12: Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents*

ASTM E679-78, *Test method for autoignition temperature of liquid chemicals*

Tableau 1 - Données d'inflammabilité
Table 1 - Flammability data

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
1	Aldéhyde acétique Acetaldehyde	CH_3CHO	1,52	−38	4,00	60,0	74	1108	204	0,92	T3	IIA
2	Acide acétique Acetic acid	CH_3COOH	2,07	40	4,00	17,0	100	428	464	1,76	T1	IIA
3	Anhydride acétique Acetic anhydride	$(CH_3CO)_2O$	3,52	49	2,00	10,0	85	428	334	1,23	T2	IIA
4	Acétone Acetone	$(CH_3)_2CO$	2,00	<−20	2,50	13,0	60	316	535	1,01	T1	IIA
5	Acétonitrile Acetonitrile	CH_3CN	1,42	2	3,00	16,0	51	275	523	1,50	T1	IIA
6	Chlorure d'acétyle Acetyl chloride	CH_3COCl	2,70	−4	5,00	19,0	157	620	390		T2	(IIA)
7	Acétylène (voir 4.3) Acetylene (see 4.3)	$CH{\equiv}CH$	0,90		2,30	100,0	24	1092	305	0,37	T2	IIC
8	Acétylé flouride Acetyl flouride	CH_3COF	2,14	<−17	5,60	19,9	142	505	434	1,54	T2	IIA
9	Acrylaldehyde	$CH_2{=}CHCHO$	1,93	−18	2,85	31,8	65	728	217	0,72	T3	IIB
10	Acide acrylique Acrylic acid	$CH_2{=}CHCOOH$	2,48	56	2,90		85		406	0,86	T2	IIB
11	Acrylonitrile Acrylonitrile	$CH_2{=}CHCN$	1,83	−5	2,80	28,0	64	620	480	0,87	T1	IIB
12	Acryloyl chloride	$CH_2CHCOCl$	3,12	−8	2,68	18,0	220	662	463	1,06	T1	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
13	Acétate d'allyle Allyl acetate	$CH_2{=}CHCH_2OOCCH_3$	3,45	13	1,70	9,3	69	3800	348	0,96	T2	IIA
14	Alcool d'allyle Allyl alcohol	$CH_2{=}CHCH_2CH$	2,00	21	2,50	18,0	61	438	378	0,84	T2	IIB
15	Chlorure d'allyle Allyl chloride	$CH_2{=}CHCH_2Cl$	2,64	–32	2,90	11,2	92	357	390	1,17	T2	IIA
16	Allyl 2, 3-epoxypropyl ether	$CH_2{=}CH\text{-}CH_2\text{-}O\text{-}\underline{CHCH_2CH_2O}$	3,94	45					249	0,70	T3	IIB
17	2-Aminoethanol	$NH_2CH_2CH_2OH$	2,10	85					410		T2	IIA
18	Ammoniac Ammonia	NH_3	0,59		15,0	33,6	107	240	630	3,18	T1	IIA
19	Amphétamine Amphetamine (INN)	$C_6H_5CH_2CH(NH_2)CH_3$	4,67	<100								IIA
20	Aniline Aniline	$C_6H_5NH_2$	3,22	75	1,20	11,0	47	425	630		T1	IIA
21	Azepane	$\underline{CH_2(CH_2)_5NH}$	3,41	23					279	1,00	T3	IIA
22	Benzaldéhyde Benzaldehyde	C_6H_5CHO	3,66	64	1,40		62		192		T4	IIA
23	Benzène Benzene	C_6H_6	2,70	–11	1,20	8,6	39	280	560	0,99	T1	IIA
24	1-Brombutane 1-Bromobutane	$CH_3(CH_2)_2CH_2Br$	4,72	13	2,50	6,6	143	380	265		T3	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/l		°C	mm		
25	2-Bromo-1,1-diethoxyethane	$(CH_3CH_2O)_2CHCH_2Br$	7,34	57					175	1,00	T4	IIA
26	Brométhane Bromoethane	CH_3CH_2Br	3,75	<–20	6,70	11,3	306	517	511		T1	IIA
27	Buta-l,3-diène Buta-1,3-diene	$CH_2=CHCH=CH_2$	1,87	–85 gaz/gas	1,40	16,3	31	365	430	0,79	T2	IIB
28	Butane Butane	C_4H_{10}	2,05	–60 gaz/gas	1,40	9,3	33	225	372	0,98	T2	IIA
29	isoButane isoButane	$(CH_3)_2CHCH_3$	2,00	gaz/gas	1,3	9,8	31	236	460	0,95	T1	IIA
30	Butan-1-ol	$CH_3(CH_2)_2CH_2OH$	2,55	29	1,70	12,0	52	372	359	0,94	T2	IIA
31	Butanone	$CH_3CH_2COCH_3$	2,48	–9	1,80	10,0	50	302	404	0,84	T2	IIB
32	But-l-ene	$CH_2=CHCH_2CH_3$	1,95	–80 gaz/gas	1,60	10,0	38	235	440	0,94	T2	IIA
33	(isomère non mentionné) But-2-enes (isomer not stated)	$CH_3CH=CHCH_3$	1,94	gaz/gas	1,60	10,0	40	228	325	0,89	T2	IIB
34	But-3-en-3-olide	$\underline{CH_2=CCHO(O)O}$	2,90	33					262	0,84	T3	IIB
35	2-(2-Butoxyethoxy)ethanol	$CH_3(CH_2)_3OCH_2CH_2OCH_2CH_2OH$	5,59	78					225	1,11	T3	IIA
36	Acétate de butyle Butyl acetate	$CH_3COOCH_2(CH_2)_2CH_3$	4,01	22	1,3	7,5	64	390	370	1,04	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		° C	mm		
37	n-Butyl acrylate	$CH_2=CHCOOC_4H_9$	4,41	38	1,2	8,0	63	425	268	0,88	T3	IIB
38	Butylamine Butylamine	$CH_3(CH_2)_3NH_2$	2,52	–12	1,7	9,8	49	286	312	0,92	T2	IIA
39	isoButylamine isoButylamine	$(CH_3)_2CHCH_2NH_2$	2,52	–20	1,47	10,8	44	330	374	1,15	T2	IIA
40	Butyl 2, 3-epoxypropyl ether	$CH_3(CH_2)_3OCH_2CHCH_2O$	4,48	44					262	0,78	T3	IIB
41	Ester butylique de l'acide hydroxyacétique Butyl glycolate	$HOCH_2COOC_4H_9$	4,45	61						0,88		IIB
42	isoButylisobutyrate	$(CH_3)_2CHCOOCH_2CH(CH_3)_2$	4,93	34	0,80		47		424	1,00	T2	IIA
43	Butylmethacrylate	$CH_2=C(CH_3)COO(CH_2)_3CH_3$	4,90	53	1,00	6,8	58	395	289	0,95	T3	IIA
44	tert-Butyl methyl ether	$CH_3OC(CH_3)_3$	3,03	–27	1,50	8,4	54	310	385	1,00	T2	IIA
45	n-Butylpropionate	$C_2H_5COOC_4H_9$	4,48	40	1,10	7,7	58	409	389	0,93	T2	IIA
46	But-l-yne	$CH_3CH_2C\equiv CH$								0,71		IIB
47	Aldéhyde de butyle Butyraldehyde	$CH_3CH_2CH_2CHO$	2,48	–16	1,80	12,5	54	378	191	0,92	T4	IIA
48	isoButyraldehyde isoButyraldehyde	$(CH_3)_2CHCHO$	2,48	–22	1,6	11,0	47	320	176	0,92	T4	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/l		°C	mm		
49	Isobutyric acid	$(CH_3)_2CHCOOH$	3,03	58					460	1,02	T2	IIA
50	Butyryl fluoride	C_3H_7COF	3,10	<–14	2,60		95		440	1,14	T1	IIA
51	Sulfure de carbone (voir 4.4) Carbon disulphide (see 4.4)	CS_2	2,64	–30	0,60	60,0	19	1900	95	0,20 0,34	T6	IIC
52	Monoxyde de carbone (voir 4.5) Carbon monoxide (saturated at 18 °C) (see 4.5)	CO	0,97		10,90	74,0	126	870	605	0,84	T1	IIB
53	Carbonyl sulphide	COS	2,07		6,5	28,5	160	700	209	1,35	T3	IIA
54	Chlorobenzène Chlorobenzene	C_6H_5Cl	3,88	28	1,40	11,0	66	520	637		T1	IIA
55	1-Chlorobutane 1-Chlorobutane	$CH_3(CH_2)_2CH_2Cl$	3,20	–12	1,80	10,0	69	386	250	1,06	T3	IIA
56	2-Chlorobutane 2-Chlorobutane	$CH_3CHClC_2H_5$	3,19	<–18	2,20	8,8	82	339	388	1,16	T2	IIA
57	1-Chloro-2, 3-epoxypropane	OCH_2CHCH_2Cl	3,30	28	2,30	34,4	86	1325	385	0,74	T2	IIB
58	Chlorethane Chloroethane	CH_3CH_2Cl	2,22		3,60	15,4	95	413	510		T1	IIA
59	Chloréthanol 2-Chloroethanol	CH_2ClCH_2OH	2,78	55	5,00	16,0	160	540	425		T2	IIA
60	Chloréthylène Chloroethylene	$CH_2=CHCl$	2,15	–78 gaz/gas	3,60	33,0	94	610	415	0,96	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		° C	mm		
61	Chlorométhane Chloromethane	CH_3Cl	1,78	−24 gaz/gas	7,60	19,0	160	410	625	1,00	T1	IIA
62	Ether clordiméthylique Chlormethyl methyl ether	CH_3OCH_2Cl	2,78	−8								IIA
63	1-Chloro-2-methylpropane	$(CH_3)_2CHCH_2Cl$	3,19	<−14	2,00	8,8	75	340	416	1,25	T2	IIA
64	2-Chloro-2-methylpropane	$(CH_3)_3CCl$	3,19	<−18					541	1,40	T1	IIA
65	3-Chloro-2-methylprop-l-ene	$CH_2=C(CH_3)CH_2Cl$	3,12	−16	2,10		77		476	1,16	T1	IIA
66	5-Chloropentan-2-one	$CH_3CO(CH_2)_3Cl$	4,16	61	2,00		98		440	1,10	T2	IIA
67	1-Chloropropane 1-Chloropropane	$CH_3CH_2CH_2Cl$	2,70	−32	2,40	11,1	78	365	520		T1	IIA
68	2-Chloropropane 2-Chloropropane	$(CH_3)_2CHCl$	2,70	<−20	2,80	10,7	92	350	590	1,23	T1	IIA
69	Chlorotrifluoroethylene	$CF_2=CFCl$	4,01	gaz/gas	4,6	64,3	220	3117	607	1,50	T1	IIA
70	1-Chloro-2,2,2-trifluoroethyl methyl ether	$CF_3CHClOCH_3$	5,12	4	8,00		484		430	2,80	T2	IIA
71	α-Chlorotoluene	$C_6H_5CH_2Cl$	4,36	60	1,20		63		585		T1	IIA
72	Naohte de houille Coal tar naphtha								272		T3	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
73	Gaz de cokerie (voir 4.1) Coke oven gas (see 4.1)											
74	Crésols (Ensemble d'isomères) Cresols (Mixed isomers)	$CH_3C_6H_4OH$	3,73	81	1,10		50		555		T1	IIA
75	Aldéhyde crotonique Crotonaldehyde	$CH_3CH{=}CHCHO$	2,41	13	2,10	16,0	62	470	280	0,81	T3	IIB
76	Cumène Cumene	$C_6H_5CH(CH_3)_2$	4,13	31	0,80	6,5	40	328	424	1,05	T2	IIA
77	Cyclobutane Cyclobutane	$CH_2\ (CH_2)_2CH_2$	1,93		1,80		42					IIA
78	Cycloheptane Cycloheptene	$CH_2(CH_2)_5CH_2$	3,39	<10	1,10	6,7	44	275				IIA
79	Cyclohexane Cyclohexene	$CH_2(CH_2)_4CH_2$	2,90	–18	1,20	8,3	40	290	259	0,94	T3	IIA
80	Cyclohexanol Cyclohexanol	$CH_2(CH_2)_4CHOH$	3,45	61	1,20	11,1	50	460	300		T3	IIA
81	Cyclohexanone Cyclohexanone	$CH_2(CH_2)_4CO$	3,38	43	1,00	9,4	42	386	419	0,98	T2	IIA
82	Cyclohexène Cyclohexene	$CH_2(CH_2)_3CH{=}CH$	2,83	–17	1,20		41		244		T3	IIA
83	Cyclohexylamine Cyclohexylamine	$CH_2(CH_2)_4CHNH_2$	3,42	32	1,60	9,4	63	372	293		T3	IIA
84	1,3-Cyclopentadiene	$CH_2CHCHCHCH$	2,30	–50					465	0,99	T1	IIA

Tableau 1 – Données d'inflammabilité *(suite)*
Table 1 – Flammability data *(continued)*

Ref	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
85	Cyclopentane Cyclopentane	$CH_2(CH_2)_3CH_2$	2,40	−37	1,4		41		320	1,01	T2	IIA
86	Cyclopentène Cyclopentene	$CH=CHCH_2CH_2CH$	2,30	<−22	1,48		41		309	0,96	T2	IIA
87	Cyclopropane Cyclopropane	$CH_2CH_2CH_2$	1,45		2,40	10,4	42	183	498	0,91	T1	IIA
88	Cyclopropyl methyl ketone	$CH_3COCHCH_2CH_2$	2,90	15	1,70		58		452	0,97	T1	IIA
89	p-Cymène p-Cymene	$CH_3C_6H_4CH(CH_3)_2$	4,62	47	0,70	6,5	39	366	436		T2	IIA
90	2,2,3,3,4,4,5,5,6,6,7,7-Dodecafluoroheptyl methacrylate	$CH_2=C(CH_3)COOCH_2(CF_2)_6H$	9,93	49	1,60		185		390	1,46	T2	IIA
91	Decahydronaphthalène Decahydronaphthalene trans	$CH_2(CH_2)_3CHCH(CH_2)_3CH_2$	4,76	54	0,70	4,9	40	284	288		T3	IIA
92	Decane (Ensemble d'isomères) Decane (Mixed isomers)	$C_{10}H_{22}$	4,90	46	0,70	5,6	41	433	201	1,05	T3	IIA
93	Ether butylique Dibutyl ether	$(CH_3(CH_2)_3)_2O$	4,48	25	0,90	8,5	48	460	198	0,88	T4	IIB
94	Peroxide de butyle di-tertiare Di-tert-butyl peroxide	$(CH_3)_3COOC(CH_3)_3$	5,0	18					170	0,84	T4	IIB
95	Dichlorobenzénes (isomère not mentionné) Dichlorobenzenes (isomer not stated)	$C_6H_4Cl_2$	5,07	66	2,20	9,2	134	564	648		T1	IIA
96	3,4-Dichlorobut-1-ene	$CH_2=CHCHClCH_2Cl$	4,31	31	1,30	7,2	66	368	469	1,38	T1	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/l		°C	mm		
97	1,3-Dichlorobut-2-ene	$CH_3CCl{=}CHCH_2Cl$	4,31	27					469	1,31	T1	IIA
98	Dichlorosilane de diéthyle Dichlorodiethylsilane	$(C_2H_5)_2SiCl_2$		24	3,40		223			0,45		IIC
99	1,1-Dichloréthane1 ,1-Dichloroethane	CH_3CHCl_2	3,42	–10	5,60	16,0	230	660	440		T2	IIA
100	1,2-Dichloréthane 1,2-Dichloroethane	CH_2ClCH_2Cl	3,42	13	6,20	16,0	255	654	438	1,82	T2	IIA
101	Dichloréthylène Dichloroethylene	$ClCH{=}CHCl$	3,55	–10	9,70	12,8	391	516	440	3,91	T2	IIA
102	1,2-Dichloropropane 1,2-Dichloropropane	$CH_3CHClCH_2Cl$	3,90	15	3,40	14,5	160	682	557		T1	IIA
103	Dicyclopentadiene (Technical)	$C_{10}H_{12}$	4,55	36	0,80		43		455	0,91	T1	IIA
104	1,2-Diethoxyethane	$C_2H_5O(CH_2)_2OC_2H_5$	4,07	16					170	0,81	T4	IIB
105	Diéthylamine Diethylamine	$(C_2H_5)_2NH$	2,53	–23	1,70	10,0	50	306	312		T2	IIA
106	Diethyl carbonate	$(CH_3CH_2O)_2CO$	4,07	24	1,4	11,7	69	570	450	0,83	T2	IIB
107	Ether éthylique Diethyl ether	$(CH_3CH_2)_2O$	2,55	–45	1,70	36,0	50	1118	160	0,87	T4	IIB
108	Oxalate de diéthyle Diethyl oxalate	$(COOCH_2CH_3)_2$	5,04	76						0,90		IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/l		° C	mm		
109	Sulfate de diéthyle Diethyl sulphate	$(CH_3CH_2)_2SO_4$	5,31	104					360	1,11	T2	IIA
110	1,1-Difluoroethylene	$CH_2{=}CF_2$	2,21		3,90	25,1	102	665	380	1,10	T2	IIA
111	Dihexyléther Dihexyl ether	$(CH_3(CH_2)_5)_2O$	6 43	75					187		T4	IIA
112	Di-isobutylamine Diisobutylamine	$((CH_3)_2CHCH_2)_2NH$	4,45	26	0,80	3,6	42	190	256	1,12	T3	IIA
113	Diisobutyl carbinol	$((CH_3)_2CHCH_2)_2CHOH$	4,97	75	0,70	6,1	42	370	290	0,93	T3	IIA
114	Di-isopentyléther Diisopentyl ether	$(CH_3)_2CH(CH_2)_2O(CH_2)_2CH(CH_3)_2$	5,45	44	1,27		104		185	0,92	T4	IIA
115	Di-isopropylamine Diisopropylamine	$((CH_3)_2CH)_2NH$	3,48	–20	1,20	6,3	49	260	285	1,02	T3	IIA
116	Di-isopropyléther Diisopropyl ether	$((CH_3)_2CH)_2O$	3,52	–28	1,00	21,0	45	900	405	0,94	T2	IIA
117	Diméthylamine Dimethylamine	$(CH_3)_2NH$	1,55	–18 gaz/gas	2,80	14,4	53	272	400	1,15	T2	IIA
118	1,2-Dimethoxyethane	$CH_3O(CH_2)_2OCH_3$	3,10	–6	1,6	10,4	60	390	197	0,72	T4	IIB
119	Dimethoxymethane	$CH_2(OCH_3)_2$	2,60	–21	3,00	16,9	93	535	247	0,86	T3	IIB
120	2-Diméthylaminoéthanol 2-Dimethylaminoethanol	$(CH_3)_2NC_2H_4OH$	3,03	39					220		T3	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/l		°C	mm		
121	3-(Dimethylamino) propiononitrile	$(CH_3)_2NHCH_2CH_2CN$	3,38	50	1,57		62		317	1,14	T2	IIA
122	Ether méthylique Dimethyl ether	$(CH_3)_2O$	1,59	–42 gaz/gas	2,70	32,0	51	610	240	0,84	T3	IIB
123	Formamide de diméthyle N,N-Dimethylformamide	$HCON(CH_3)_2$	2,51	58	1,80	16,0	55	500	440	1,08	T2	IIA
124	3,4-Dimethyl hexane	$CH_3CH_2CH(CH_3)CH(CH_3)CH_2CH_3$	3,87	2	0,80	6,5	38	310	305		T2	IIA
125	N,N-Dimethylhydrazine	$(CH_3)_2NNH_2$	2,07	–18	2,4	20	60	490	240	0,85		IIB
126	1,4-Dimethylpiperazine	$NH(CH_3)CH_2CH_2NH(CH_3)CH_2CH_2$	3,93	9					199	1,00	T4	IIA
127	N,N-Dimethylpropane-1,3-diamine	$(CH_3)_2N(CH_2)_3NH_2$	3,52	26	1,20		50		219	0,95	T3	IIA
128	Sulfate de diméthyle Dimethyl sulphate	$(CH_3O)_2SO_2$	4,34	39					449	1,00	T2	IIA
129	1,4-Dioxane 1,4-Dioxane	$OCH_2CH_2OCH_2CH_2$	3,03	11	1,90	22,5	74	813	379	0,70	T2	IIB
130	1,3-Dioxolane 1,3-Dioxolane	$OCH_2CH_2OCH_2$	2,55	–5	2,3	30,5	70	935	245		T3	IIB
131	Dipentène, brut Dipentene, crude	$C_{10}H_{16}$	4,66	42	0,75	6,1	43	348	255	1,18	T3	IIA
132	Dipentylether Dipentyl ether	$(CH_3(CH_2)_4)_2O$	5,45	57					171		T4	

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
133	Dipropylamine Dipropylamine	$(CH_3CH_2CH_2)_2NH$	3,48	4	1,60	9,1	66	376	280	0,95	T3	IIA
134	Dipropyléther Dipropyl ether	$(C_3H_7)_2O$	3,53	<–5					215		T3	IIB
135	1,2-Epoxypropene	$CH_3\underbrace{CHCH_2O}$	2,00	–37	1,90	37,0	49	901	430	0,70	T2	IIB
136	Ethane Ethane	CH_3CH_3	1,04		2,50	15,5	31	194	515	0,91	T1	IIA
137	Ethanethiol	CH_3CH_2SH	2,11	<–20	2,80	18,0	73	468	295	0,90	T3	IIB
138	Ethanol Ethanol	CH_3CH_2OH	1,59	12	3,1	19,0	59	359	363	0,91	T2	IIA
139	Ethanol éthoxylé 2-Ethoxyethanol	$CH_3CH_2OCH_2CH_2OH$	3,10	40	1,80	15,7	68	593	235	0,84	T3	IIB
140	Acétate d'éthanol éthoxylé 2-Ethoxyethyl acetate	$CH_3COOCH_2CH_2OCH_2CH_3$	4,72	47	1,20	12,7	65	642	380	0,97	T2	IIA
141	2- (2-Ethoxyethoxy) ethanol	$CH_3CH_2OCH_2CH_2OCH_2CH_2OH$	4,62	94					190	0,94	T4	IIA
142	Acétate d'éthyle Ethyl acetate	$CH_3COOCH_2CH_3$	3,04	–4	2,20	11,0	81	406	460	0,99	T1	IIA
143	Acétylacétate d'éthyle Ethyl acetoacetate	$CH_3COCH_2COOCH_2CH_3$	4,50	65	1,00	9,5	54	519	350	0,96	T2	IIA
144	Acrylate d'éthyle Ethyl acrylate	$CH_2{=}CHCOOCH_2CH_3$	3,45	9	1,40	14,0	59	588	350	0,86	T2	IIB

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
145	Ethylamine Ethylamine	$C_2H_5NH_2$	1,50	<–20	2,68	14,0	49	260	425	1,20	T2	IIA
146	Ethylbenzène Ethylbenzene	$CH_2CH_3C_6H_5$	3,66	23	1,00	7,8	44	340	431		T2	IIA
147	Ethyl butyrate Ethyl butyrate	$CH_3CH_2CH_2COOC_2H_5$	4,00	21	1,40		66		435	0,92	T2	
148	Ethylcyclobutane Ethylcyclobutane	$CH_3CH_2\underline{CHCH_2CH_2CH_2}$	2,90	<–16	1,20	7,7	42	272	212		T3	IIA
149	Ethylcyclohexane Ethylcyclohexane	$CH_3CH_2\underline{CH(CH_2)_4CH_2}$	3,87	<24	0,90	6,6	42	310	238		T3	IIA
150	Ethylcyclopentane Ethylcyclopentane	$CH_3CH_2\underline{CH(CH_2)_3CH_2}$	3,40	<5	1,05	6,8	42	280	262		T3	IIA
151	Ethylène Ethylene	$CH_2=CH_2$	0,97		2,3	36,0	26	423	425	0,65	T2	IIB
152	Ethylenediamine	$NH_2CH_2CH_2NH_2$	2,07	34	2,7	16,5	64	396	403	1,18	T2	IIA
153	Oxyde d'éthylène Ethylene oxide	$\underline{CH_2CH_2O}$	1,52	<–18	2,60	100,0	47	1848	435	0,59	T2	IIB
154	Formiate d'éthyle Ethyl formate	$HCOOCH_2CH_3$	2,55	–20	2,70	16,5	87	497	440	0,91	T2	IIA
155	2-Ethylhexyl acetate	$CH_3COOCH_2CH(C_2H_5)C_4H_9$	5,94	44	0,75	6,2	53	439	335	0,88	T2	IIB
156	Ethyl isobutyrate	$(CH_3)_2CHCOOC_2H_5$	4,00	10	1,60		75		438	0,96	T2	IIA

Tableau 1 – Données d'inflammabilité *(suite)*
Table 1 – Flammability data *(continued)*

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits Inf Lower	Sup Upper	Inf Lower	Sup Upper	Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
				° C	vol pour cent vol per cent		mg/1		° C	mm		
157	Méthacrylate d'éthyle Ethyl methacrylate	$CH_2=CCH_3COOCH_2CH_3$	3,90	(20)	1,50		70			1,01		IIA
158	Ethyl methyl ether	$CH_3OCH_2CH_3$	2,10		2,00	10,1	50	255	190		T4	IIB
159	Nitrite d'éthyle (voir 4.2) Ethyl nitrite (see 4.2)	CH_3CH_2ONO	2,60	–35	3,00	50,0	94	1555	95	0,96	T6	IIA
160	0-Ethyl phosphorodichloridothioate	$C_2H_5OPSCl_2$	7,27	75					234	1,20	T3	IIA
161	(isomère non mentionné) Ethylpropylacrolein (isomer not stated)	$C_8H_{14}O$	4,34	40					184	0,86	T4	IIB
162	Formaldéhyde Formaldehyde	HCHO	1,03		7,00	73,0	88	920	424	0,57	T2	IIB
163	acide formique Formic acid	HCOOH	1,60	42	10,0	57,0	190	1049	520	1,86	T1	IIA
164	2-Furaldehyde	OCH=CHCH=CHCHO	3,30	60	2,10	19,3	85	768	316	0,88	T2	IIB
165	Furane Furan	CH=CHCH=CHO	2,30	<–20	2,30	14,3	66	408	390	0,68	T2	IIB
166	Furfuryl alcohol	$OC(CH_2OH)CHCHCH$	3,38	61	1,8	16,3	70	670	370	0,8	T2	IIB
167	1,2,3-Trimethylbenzene	$CHCHCHC(CH_3)C(CH_3)C(CH_3)$	4,15	51	0,80	7,0			470		T1	IIA
168	Heptane (ensemble d'isomères) Heptane (mixed isomers)	C_7H_{16}	3,46	–4	1,10	6,7	46	281	215	0,91	T3	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/l		° C	mm		
169	Heptan-1-ol	$CH_3(CH_2)_5\ CH_2OH$	4,03	60					275	0,94		IIA
170	Heptan-2-one	$CH_3CO(CH_2)_4CH_3$	3,94	39	1,10	7,9	52	378	533		T1	IIA
171	Hept-2-ene	$CH_3(CH_2)_3CH{=}CHCH_3$	3,40	<0					263	0,97	T3	IIA
172	Hexane (ensemble d'isomères) Hexane (mixed isomers)	$CH_3(CH_2)_4CH_3$	2,97	–21	1,00	8,4	35	290	233	0,93	T3	IIA
173	1-Hexanol 1-Hexanol	$C_6H_{13}OH$	3,50	63	1,20		51		293	0,98	T3	IIA
174	Hexan-2-one	$CH_3CO(CH_2)_3CH_3$	3,46	23	1,20	8,0	50	336	533		T1	IIA
175	Hydrogène Hydrogen	H_2	0,07		4,00	77,0	3,4	63	560	0,28	T1	IIC
176	Cyanogène Hydrogen cyanide	HCN	0,90	<–20	5,40	46,0	60	520	538	0,80	T1	IIB
177	Sulfure d'hydrogène Hydrogen sulfide	H_2S	1,19		4,00	45,5	57	650	270	0,89	T3	IIB
178	4-Hydroxy-4-methylpenta-2-one	$CH_3COCH_2C(CH_3)_2OH$	4,00	58	1,80	6,9	88	336	680		T1	IIA
179	Kérosène Kerosene			38	0,70	5,0			210		T3	IIA
180	1,3,5-Trimethylbenzene	$CHCCH_3)CHC(CH_3)CHC(CH_3)$	4,15	44	0,8	7,3	40	365	499	0,98	T1	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
181	Métaldéhyde Metaldehyde	$(C_2H_4O)_4$	6,10	36								IIA
182	Methacryloyl chloride	CH_2CCH_3COCl	3,60	17	2,50		106		510	0,94	T1	IIA
183	Méthane (grisou) Methane (firedamp)	CH_4	0,55		4,40	17,0	29	113	537	1,14	T1	I
184	Méthane (voir 4.6) Methane (see 4.6)	CH_4			4,40	17,0	29	113	537		T1	IIA
185	Méthanol Methanol	CH_3OH	1,11	11	5,50	36,0	73	484	386	0,92	T2	IIA
186	Methanethiol	CH_3SH	1,60		4,1	21,0	80	420	340	1,15	T2	IIA
187	Méthoxyéthanol 2-Methoxyethanol	$CH_3OCH_2CH_2OH$	2,63	39	2,40	20,6	76	650	285	0,85	T3	IIB
188	Acétate de méthyle Methyl acetate	CH_3COOCH_3	2,56	−10	3,20	16,0	99	475	502		T1	IIA
189	Acétylacétate de méthyle Methyl acetoacetate	$CH_3COOCH_2COCH_3$	4,00	62	1,30	14,2	62	685	280	0,85	T3	IIB
190	Acrylate de méthyle Methyl acrylate	$CH_2=CHCOOCH_3$	3,00	−3	2,40	25,0	85	903	415	0,85	T2	IIB
191	Méthylamine Methylamine	CH_3NH_2	1,00	−18 gaz/gas	4,20	20,7	55	270	430		T2	IIA
192	Méthyl butane 2-Methylbutane	$(CH_3)_2CHCH_2CH_3$	2,50	<−51	1,30	8,0	38	242	420	0,98	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
193	2-Methylbutan-2-ol	$CH_3CH_2C(OH)(CH_3)_2$	3,03	18	1,40	10,2	50	374	392	1,10	T2	IIA
194	3-Methylbutan-1-ol	$(CH_3)_2CH(CH_2)_2OH$	3,03	42	1,30	10,5	47	385	339	1,06	T2	IIA
195	2-Methylbut-2-ene	$(CH_3)_2C{=}CHCH_3$	2,40	–53	1,30	6,6	37	189	290	0,96	T3	IIA
196	Methyl chloroformate	CH_3OOCC	3,30	10	7,5	26	293	1020	475	1,20	T1	IIA
197	Méthyl cyclobutane Methylcyclobutane	$CH_3CH_2CH_2CH_2$										IIA
198	Méthyl cyclohexane Methylcyclohexane	$CH_3CH(CH_2)_4CH_2$	3,38	–4	1,15	6,7	47	275	258		T3	IIA
199	Méthyl cyclohexanols Methylcyclohexanols	$CH_3C_6H_{10}OH$	3,93	68					295		T3	IIA
200	(isomère non mentionné) Methylcyclopentadienes (isomer not stated)	C_6H_8	2,76	<–18	1,30	7,6	43	249	432	0,92	T2	IIA
201	Méthyl cyclopentane Methylcyclopentane	$CH_3CH(CH_2)_3CH_2$	2,90	<–10	1,00	8,4	35	296	258		T3	IIA
202	Méthylène cyclobutane Methylenecyclobutane	$C(=CH_2)CH_2CH_2CH_2$	2,35	<0	1,25	8,6	35	239	352	0,76	T2	IIB
203	4-Methylenetetrahydropyran	$OCH_2CH_2C(=CH_2)CH_2CH_2$	3,78	2	1,50		60		255	0,89	T3	IIB
204	2-Methyl-l-buten-3-yne	$HC \equiv CC(CH_3)CH_2$	2,28	–54	1,40		38		272	0,78	T3	IIB

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
205	Formiate de méthyle Methyl formate	$HCOOCH_3$	2,07	−20	5,00	23,0	125	580	450		T2	IIA
206	2-Methylfuran	$OC(CH_3)CHCHCH$	2,83	<−16	1,40	9,7	47	325	318	0,95	T2	IIA
207	2-Methylhexa-3, 5-dien-2-ol	$CH_2{=}CHC{=}CC(OH)(CH_3)_2$	3,79	24					347	1,14	T2	IIA
208	Methylisocyanate	CH_3NCO	1,96	−7	5,30	26,0	123	605	517	1,21	T1	IIA
209	Méthacrylate de méthyle Methyl methacrylate	$CH_3{=}CCH_3COOCH_3$	3,45	10	1,70	12,5	71	520	430	0,95	T2	IIA
210	Methyl 2-methoxypropionate	$CH_3CH(CH_3O)COOCH_3$	4,06	48	1,20		58		211	1,07	T3	IIA
211	4-Methylpentan-2-ol	$(CH_3)_2CHCH_2CHOHCH_3$	3,50	37	1,14	5,5	47	235	334	1,01	T2	IIA
212	4-Methylpentan-2-one	$(CH_3)_2CHCH_2COCH_3$	3,45	16	1,20	8,0	50	336	475	1,01	T1	IIA
213	2-Methylpent-2-enal	$CH_3CH_2CHC(CH_3)COH$	3,78	30	1,46		58		206	0,84	T3	IIB
214	4-Methylpent-3-en-2-one	$(CH_3)_2(CCHCOCH)_3$	3,78	24	1,60	7,2	64	289	306	0,93	T2	IIA
215	2-Methylpropan-l-ol	$(CH_3)_2CHCH_2OH$	2,55	28	1,70	9,8	52	305	408	0,96	T2	IIA
216	2-Methylprop-l-ene	$(CH_3)_2C{=}CH_2$	1,93	gas/gaz	1,6	10	37	235	483	1,0	T1	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
217	2-Methylpyridine	$NCH(CH_3)CHCHCHCH$	3,21	27	1,20		45		533	1,08	T1	IIA
218	3-Methylpyridine	$NCHCH(CH_3)CHCHCH$	3,21	43	1,40	8,1	53	308	537	1,14	T1	IIA
219	4-Methylpyridine	$NCHCHCH(CH_3)CHCH$	3,21	43	1,10	7,8	42	296	534	1,12	T1	IIA
220	α-Styrène de méthyle α-Methyl styrene	$C_6H_5C(CH_3)=CH_2$	4,08	40	0,90	6,6	44	330	445	0,88	T2	IIB
221	Methyl tert-pentyl ether	$(CH_3)_2C(OCH_3)CH_2CH_3$	3,50	<–14	1,50		62		345	1,01	T2	IIA
222	2-Methylthiophene	$SC(CH_3)CHCHCH$	3,40	–1	1,30	6,5	52	261	433	1,15	T2	IIA
223	2-Methyl-5-vinylpyridine	$NC(CH_3)CHCHC(CH_2=CH)CH$	4,10	61					520	1,30	T1	IIA
224	Morpholine Morpholine	$OCH_2CH_2NHCH_2CH_2$	3,00	31	1,80	15,2	65	550	230	0,92	T3	IIA
225	Naphte Naphtha		2,50	<–18	0.90	6.0			290		T3	IIA
226	Naphtalène Naphthalene	$C_{10}H_8$	4,42	77	0.90	5.9	48	317	528		T1	IIA
227	Nitrobenzène Nitrobenzene	$CH_3CH_2NO_2$	4,25	88	1,70	40,0	87	2067	480	0.94	T1	IIA
228	Nitroethane Nitroethane	$C_2H_5NO_2$	2,58	27	3.40		107		410	0,87	T2	IIB

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
229	Nitromethane Nitromethane	CH_3NO_2	2,11	36	7,30	63,0	187	1613	415	1,17	T2	IIA
230	I-Nitropropane I-Nitropropane	$CH_3CH_2CH_2NO_2$	3,10	36	2,20		82		420	0,84	T2	IIB
231	Nonane Nonane	$CH_3(CH_2)_7CH_2$	4,43	30	0,70	5,6	37	301	205		T3	IIA
232	2,2,3,3,4,4,5,5-Octafluoro-1,1-dimethylpentan-I-ol	$H(CF_2CF_2)_2C(CH_3)_2OH$	8,97	61					465	1,50	T1	IIA
233	Octaldéhyde Octaldehyde	$CH_3(CH_2)_6CHO$	4,42	52								IIA
234	Octane Octane	$CH_3(CH_2)_6CH_3$	3,93	13	0,80	6,5	38	311	206	0,94	T3	IIA
235	I-Octanol I-Octanol	$CH_3(CH_2)_6CH_2OH$	4,50	81	0,9	7,4	49	385	270	1,05	T3	IIA
236	(ensemble d'isomeres) Octene (mixed isomers)	C_8H_{16}	3,66	–18	1,10	5,9	50	270	264	0,95	T3	IIA
237	Paraformaldéhyde Paraformaldehyde	poly(CH_2O)		70	7,00	73,0			380	0,57	T2	IIB
238	Penta-I,3-diene	CH_2=CH-CH=CH-CH_3	2,34	<–31	1,2	9,4	35	261	361	0,97	T2	IIA
239	Pentanes (ensemble d'isomères) Pentanes (mixed isomers)	C_5H_{12}	2,48	–40	1,40	7,8	42	236	258	0,93	T3	IIA
240	Pentane-2,4-dione	$CH_3COCH_2COCH_3$	3,50	34	1,70		71		340	0,96	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
241	Pentan-l-ol	$CH_3(CH_2)_3CH_2OH$	3,03	38	1,06	10,5	36	385	298	1,30	T3	IIA
242	Pentanols (ensemble d'isomères) Pentanols (mixed isomers)	$C_5H_{11}OH$	3,04	34	1,20	10,5	44	388	300	1,02	T3	IIA
243	Pentan-3-one	$(CH_3CH_2)_2CO$	3,00	12	1,60		58		445	0,90	T2	IIA
244	Pentyl acetate	$CH_3COO\text{-}(CH_2)_4\text{-}CH_3$	4,48	25	1,00	7,1	55	387	360	1,05	T2	IIA
245	Pétrole Petroleum		2,8	<–20	1,2	8,0			560		T1	IIA
246	Phénol Phenol	C_6H_5OH	3,24	75	1,3	9,5	50	370	595		T1	IIA
247	Phenylacetylene	$C_6H_5C{\equiv}CH$	3,52	41					420	0,86	T2	IIB
248	Propane Propane	$CH_3CH_2CH_3$	1,56	–104 gas/gaz	1,70	10,9	31	200	470	0,92	T1	IIA
249	Propan-l-ol	$CH_3CH_2CH_2OH$	2,07	22	2,20	17,5	55	353	405	0,89	T2	IIB
250	Propan-2-ol	$(CH_3)_2CHOH$	2,07	12	2,00	12,7	50	320	425	1,00	T2	IIA
251	Propene	$CH_2{=}CHCH_3$	1,50		2,00	11,0	35	194	455	0,91	T1	IIA
252	Propionic acid	CH_3CH_2COOH	2,55	52	2,1	12,0	64	370	435	1,10	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Ign temp Temp d'infl	MESG IEMS	T class Classe de T	Group Groupe
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
253	Propionic aldehyde	C_2H_5CHO	2,00	<–26	2,00		47		188	0,86	T4	IIB
254	Acétate de propyle Propyl acetate	$CH_3COOCH_2CH_2CH_3$	3,50	10	1,70	8,0	70	343	430	1,04	T2	IIA
255	isoPropyl acetate	$CH_3COOCH(CH_3)_2$	3,51	4	1,8	8,1	75	340	467	1,16	T1	IIA
256	Propylamine Propylamine	$CH_3(CH_2)_2NH_2$	2,04	–37	2,00	10,4	49	258	318	1,13	T2	IIA
257	isoPropylamine	$(CH_3)_2CHNH_2$	2,03	<–24	2,30	8,6	55	208	340	1,05	T2	IIA
258	isoPropyl chloroacetate	$ClCH_2COOCH(CH_3)_2$	4,71	42	1,60		89		426	1,24	T2	IIA
259	isoPropyl formate	$HCOOCH(CH_3)_2$	3,03	<–6					469	1,10	T1	IIA
260	2-isoPropyl-5-methylhex-2-enal	$(CH_3)_2CH\text{-}C(CHO)CHCH_2CH(CH_3)_2$	5,31	41	3,05		192		188	>1,0	T4	IIA
261	Nitrate d'isopropyle isoPropyl nitrate	$(CH_3)_2CHONO_2$		11	2,00	100,0	75	3738	175		T4	IIB
262	Propyne	$CH_3C\equiv CH$	1,38		1,70	16,8	28	280				IIB
263	Prop-2-yn-l-ol	$HC\equiv CCH_2OH$	1,89	33	2,40		55		346	0,58	T2	IIB
264	Pyridine Pyridine	C_5H_5N	2,73	17	1,70	12,0	56	398	550		T1	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits Inf Lower	 Sup Upper	 Inf Lower	 Sup Upper	Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
				° C	vol pour cent vol per cent		mg/1		° C	mm		
265	Styrène Styrene	$C_6H_5CH{=}CH_2$	3,60	30	1,10	8,0	48	350	490		T1	IIA
266	2,2,3,3-Tetrafluoro-1,1-dimethylpropan-l-ol	$HCF_2CF_2C(CH_3)_2OH$	5,51	35					447	1,42	T2	IIA
267	Tétrafluoréthylène Tetrafluoroethylene	$CF_2{=}CF_2$	3,40		10,00	59,0	420	2245	255	0,60	T3	IIB
268	1,1,2,2-Tetrafluoroethoxybenzene	$C_6H_5OCF_2CF_2H$	6,70	47	1,60		126		483	1,22	T1	IIA
269	2,2,3,3-Tetrafluoropropan-l-ol	$HCF_2CF_2CH_2OH$	4,55	43					437	1,90	T2	IIA
270	2,2,3,3-Tetrafluoropropyl acrylate	$CH_2{=}CHCOOCH_2CF_2CF_2H$	6,41	45	2,40		182		357	1,18	T2	IIA
271	2,2,3,3-Tetrafluoropropyl methacrylate	$CH_2{=}C(CH_2)COOCH_2CF_2CF_2H$	6,90	46	1,90		155		389	1,18	T2	IIA
272	Tetrahydrofuran	$CH_2(CH_2)_2CH_2O$	2,49	–20	1,50	12,4	46	370	224	0,87	T3	IIB
273	Alcool tétrahydrofurfurylique Tetrahydrofurfuryl alcohol	$OCH_2CH_2CH_2CHCH_2OH$	3,52	70	1,50	9,7	64	416	280	0,85	T3	IIB
274	Tetrahydrothiophène Tetrahydrothiophene	$CH_2(CH_2)_2CH_2S$	3,04	13	1,10	12,3	42	450	200	0,99	T3	IIA
275	N,N,N',N'-Tetramethylmethanediamine	$(CH_3)_2NCH_2N(CH_3)_2$	3,5	<–13	1,61		67		180	1,06	T4	IIA
276	Thiophène Thiophene	$CH{=}CHCH{=}CHS$	2,90	–9	1,5	12,5	50	420	395	0,91	T2	IIA

Tableau 1 – Données d'inflammabilité (*suite*)
Table 1 – Flammability data (*continued*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				°C	vol pour cent vol per cent		mg/1		°C	mm		
277	Toluène Toluene	$C_6H_5CH_3$	3,20	4	1,1	7,8	42	300	535		T1	IIA
278	1,1,3-Triethoxybutane	$(CH_3CH_2O)_2CHCH_2CH(CH_3CH_2O)CH_3$	6,56	33	0,78	5,8	60	451	165	0,95	T4	IIA
279	Triéthylamine Triethylamine	$(CH_3CH_2)_3N$	3,50	–7	1,20	8,0	51	339				IIA
280	1,1,1-Trifluoroethane	CF_3CH_3	2,90		6,80	17,6	234	605	714	>2,00	T1	IIA
281	2,2,2-Trifluoroethanol	CF_3CH_2OH	3,45	30	8,4	28,8	350	1195	463	3,00	T1	IIA
282	Trifluoroethylene	$CF_2{=}CFH$	2,83		15,30	27,0	502	904	319	1,40	T2	IIA
283	3,3,3-Trifluoroprop-l-ene	$CF_3CH{=}CH_2$	3,31		4,70		184		490	1,75	T1	IIA
284	Triméthylamine Trimethylamine	$(CH_3)_3N$	2,04		2,00	12,0	50	297	190	1,05	T4	IIA
285	4,4,5-Trimethyl-1,3-dioxane	$OCH_2OCH(CH_3)C(CH_3)_2CH_2$	4,48	35					284	0,90	T3	IIA
286	2,2,4-Trimethylpentane	$(CH_3)_2CHCH_2C(CH_3)_3$	3,90	–12	1,0	6,0	47	284	411	1,04	T2	IIA
287	2,4,6-Trimethyl-1,3,5-trioxane	$OCH(CH_3)OCH(CH_3)OCH(CH_3)$	4,56	27	1,30		72		235	1,01	T3	IIA
288	1,3,5-Trioxane 1,3,5-Trioxane	$OCH_2OCH_2OCH_2$	3,11	45	3,20	29,0	121	1096	410	0,75	T2	IIB

Tableau 1 – Données d'inflammabilité (*fin*)
Table 1 – Flammability data (*concluded*)

Ref.	Gaz ou vapeur Gas or vapour	Formule Formula	Rho ρ	PE FP	Limites d'inflammabilité Flammability limits				Temp d'infl Ign temp	IEMS MESG	Classe de T T class	Groupe Group
					Inf Lower	Sup Upper	Inf Lower	Sup Upper				
				° C	vol pour cent vol per cent		mg/1		° C	mm		
289	Térébenthine Turpentine			35	0,80				254		T3	IIA
290	isoValeraldehyde	$(CH_3)_2CHCH_2CHO$	2,97	–12	1,70		60		207	0,98	T3	IIA
291	Acétate de vinyle Vinyl acetate	$CH_3COOCH=CH_2$	3,00	–8	2,60	13,4	93	478	425	0,94	T2	IIA
292	(isomère non mentionné) Vinyl cyclohexenes (isomer not stated)	$CH_2CHC_6H_9$	3,72	15	0,80		35		257	0,96	T3	IIA
293	Vinylidene chloride	$CH_2=CCl_2$	3,40	–18	7,30	16,0	294	645	440	3,91	T2	IIA
294	2-Vinyloxyethanol	$CH_2=CH\text{-}OCH_2CH_2OH$	3,04	52					250	0,86	T3	IIB
295	2-Vinylpyridine	$NC(CH_2=CH)CHCHCHCH$	3,62	35	1,20		51		482	0,96	T1	IIA
296	4-Vinylpyridine	$NCHCHC(CH_2=CH)CHCH$	3,62	43	1,10		47		501	0,95	T1	IIA
297	Gaz de l'eau Water gas			1,2							T1	IIC
298	Xylènes Xylenes	$C_6H_4(CH_3)_2$	3,66	30	1,00	7,6	44	335	464	1,09	T1	IIA
299	Xylidenes	$C_6H_3(CH_3)_2NH_2$	4,17	96	1,00	7,0	50	355	370		T2	

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Annex A

Bibliography

Further data on the properties of flammable materials may be found in the following references and databases, some of which were used in the compilation of the tables 1 and 2.

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MGIPF—776 Deptt. of BIS/2008—18.10.2008 300 Books

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Amendment No.	Date of Issue	Text Affected

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Western :	Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	2832 9295, 2832 7858 2832 7891, 2832 7892

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